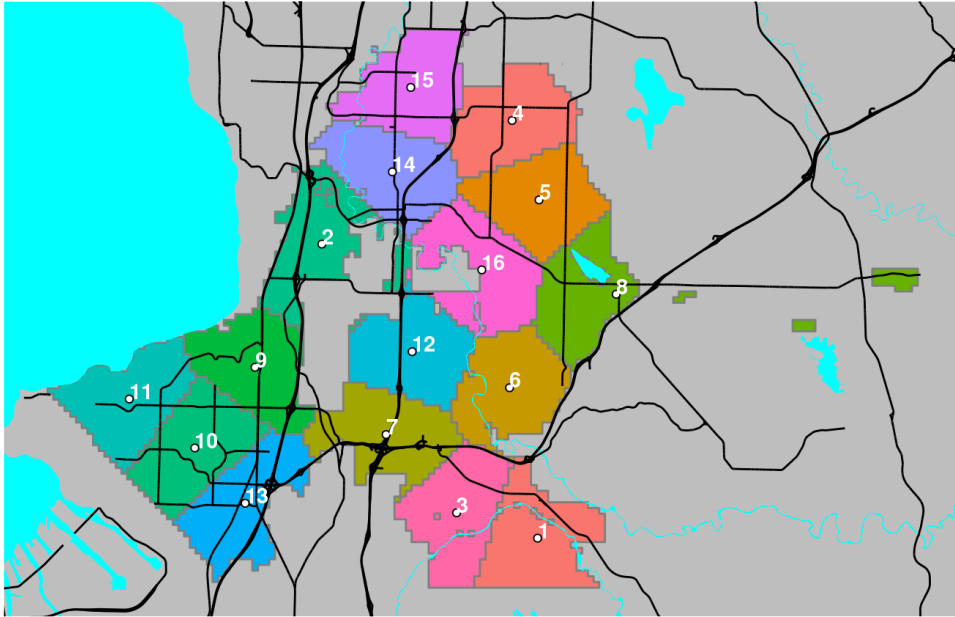
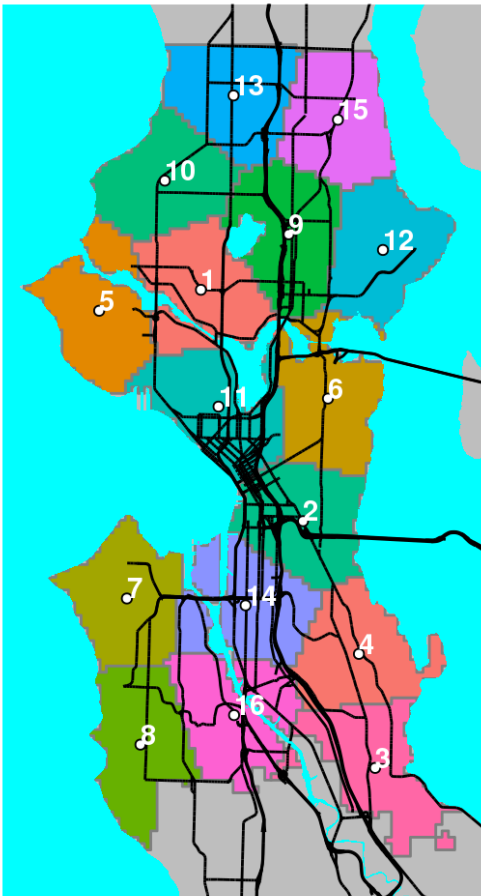


Supplemental Materials

FIGURE S1. MAP OF COMPARISON AREA: 16 EQUAL SIZED SPATIAL SAMPLING UNITS



MAP OF SEATTLE: 16 EQUAL SIZED SPATIAL SAMPLING UNITS



SUPPLEMENTAL TABLE S1. BEVERAGE TYPES MEASURED BY CATEGORY

ALL SURVEYED BEVERAGES BY BEVERAGE TYPE AND BEVERAGE TAX STATUS

| TAXED BEVERAGES | NON-TAXED NO SUGAR ADDED BEVERAGES | NON-TAXED SUGAR-SWEETENED BEVERAGES |
|---|--|--|
| <p>SODA</p> <ul style="list-style-type: none"> COCA COLA DR. PEPPER FANTA JARRITOS MOUNTAIN DEW PEPSI SODA, LOWEST PRICE AVAILABLE <p>JUICE DRINK</p> <ul style="list-style-type: none"> CAPRISUN TROPICANA FRUIT TWIST DRINK KIRKLAND CRANBERRY JUICE COCKTAIL KOOL-AID MINUTE MAID CRANBERRY JUICE COCKTAIL MINUTE MAID FRUIT PUNCH TROPICANA CRANBERRY JUICE COCKTAIL JUICE DRINK, LOWEST COST AVAILABLE <p>SPORTS DRINK</p> <ul style="list-style-type: none"> GATORADE POWERADE VITAMIN WATER <p>ENERGY DRINK</p> <ul style="list-style-type: none"> MONSTER ENERGY DRINK RED BULL ENERGY DRINK <p>TEA BOTTLED</p> <ul style="list-style-type: none"> ARIZONA TEA PURE LEAF TEA <p>TEA PREPARED</p> <ul style="list-style-type: none"> BUBBLE TEA, NON-MILK BASED <p>COFFEE BOTTLED</p> <ul style="list-style-type: none"> STARBUCKS FRAPPUCCINO <p>SUGARY FLAVOR SHOT</p> | <p>DIET SODA</p> <ul style="list-style-type: none"> COCA COLA ZERO COCA COLA DIET DR. PEPPER DIET MOUNTAIN DEW DIET PEPSI DIET JARRITOS LIGHT <p>JUICE 100%</p> <ul style="list-style-type: none"> CAPRISUN 100% JUICE KIRKLAND APPLE 100% JUICE KIRKLAND ORANGE 100% JUICE MINUTE MAID ORANGE 100% JUICE TROPICANA ORANGE 100% JUICE TREETOP APPLE 100% JUICE <p>DIET SPORTS DRINK</p> <ul style="list-style-type: none"> POWERADE ZERO VITAMIN WATER ZERO GATORADE G2 <p>DIET ENERGY DRINK</p> <ul style="list-style-type: none"> MONSTER ENERGY DRINK ZERO RED BULL ENERGY DRINK SUGAR-FREE <p>WATER</p> <ul style="list-style-type: none"> LA CROIX WATER <p>MILK</p> <ul style="list-style-type: none"> WHITE MILK, ALL FAT CONTENTS <p>POWDERED DRINKS, SUGAR-FREE</p> <ul style="list-style-type: none"> CRYSTAL LITE LEMONADE KOOL-AID CHOCOLATE MILK <p>TEA BOTTLED</p> <ul style="list-style-type: none"> ARIZONA TEA, UNSWEETENED PURE LEAF TEA, UNSWEETENED <p>BUBBLE TEA PREPARED</p> <ul style="list-style-type: none"> BUBBLE TEA, SUGAR-FREE BUBBLE TEA, UNSWEETENED TEA FRUIT SMOOTHIE <p>COFFEE PREPARED</p> <ul style="list-style-type: none"> COFFEE, DRIP COFFEE, LATTE PLAIN COFFEE, LATTE SUGAR-FREE FLAVORED <p>SUGAR-FREE FLAVOR SHOT</p> | <p>CHOCOLATE MILK</p> <ul style="list-style-type: none"> CHOCOLATE MILK, ALL FAT CONTENTS <p>POWDERED DRINKS</p> <ul style="list-style-type: none"> GATORADE G2 GATORADE CHOCOLATE MILK COUNTRY TIME LEMONADE KOOL-AID <p>BUBBLE TEA PREPARED</p> <ul style="list-style-type: none"> BUBBLE TEA SWEETENED, MILK-BASED <p>COFFEE PREPARED</p> <ul style="list-style-type: none"> COFFEE LATTE SWEETENED COFFEE MOCHA |

Supplemental Table S2. Adjusted estimated effect of the tax on prices of beverages (in cents per ounce) in Seattle at 6-months post-tax

| | Unbalanced ¹ | | Balanced ² | |
|------------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| | DID (95% CI) ³ | Pass-through ⁴ | DID (95% CI) ³ | Pass-through ⁴ |
| Taxed Beverages⁵ | | | | |
| All Taxed Beverages ^{6,7} | 1.67 (1.48, 1.85)* | 95% | 1.58 (1.42, 1.75)* | 90% |
| Soda | 1.72 (1.55, 1.89)* | 98% | 1.66 (1.51, 1.80)* | 95% |
| Sports Beverages | 1.31 (1.04, 1.59)* | 75% | 1.33 (1.07, 1.59)* | 76% |
| Energy Beverages | 1.89 (1.35, 2.43)* | 108% | 1.82 (1.39, 2.25)* | 104% |
| Juice Beverages | 1.15 (0.65, 1.65)* | 66% | 1.21 (0.68, 1.75)* | 69% |
| Tea, Bottled | 1.53 (1.11, 1.94)* | 87% | 1.46 (1.12, 1.80)* | 83% |
| Sugary Syrup Add On ⁸ | 9.38 (-4.91, 23.67) | -- | 9.38 (-4.93, 23.69) | -- |
| Coffee, Bottled | 1.12 (0.17, 2.07)* | 64% | 1.02 (0.06, 1.98)* | 58% |
| Store Type⁶ | | | | |
| Superstores/Supermarkets | 1.45 (1.22, 1.68) * | 83% | 1.47 (1.23, 1.71) * | 84% |
| Grocery/Drug Stores | 1.84 (1.45, 2.24) * | 105% | 1.78 (1.41, 2.15) * | 102% |
| Small Stores | 1.78 (1.42, 2.14) | 102% | 1.66 (1.38, 1.93)* | 95% |
| Warehouses ⁹ | 1.24 (-1.60, 4.07) | 71% | 1.24 (-1.85, 4.33) | 71% |
| Coffee Shops ⁸ | 9.38 (-4.91, 23.67) | -- | 9.38 (-4.93, 23.69) | -- |
| Quick Service Restaurants | 1.61 (0.73, 2.50) * | 92% | 0.88 (0.20, 1.55) * | 50% |

CI = confidence interval; DID= difference-in-difference

¹ Unbalanced models include all measured beverages, regardless of whether the beverage was present, in the same store at baseline and 6-month store audits.

² Balanced models include beverages (unique brand, specification and size) that were present in the same at baseline and 6-month store audits.

³ Tax effects are estimated using difference-in-difference models. The estimate (cents per ounce) represents the effect of tax between baseline and 6-months, above the price changes in the comparison area. Standard errors are clustered at the store-level.

⁴ The percent of the 1.75 cents/ounce passed on to consumers.

⁵ Models include store fixed effects and beverage size as covariates.

⁶ Models include store fixed effects, beverage size, and beverage type as covariates.

⁷ Excludes sugary syrup add on.

⁸ Cents per flavor shot.

⁹ Standard errors are not clustered.

* $p < 0.05$

Supplemental Table S3: The estimated effect of the tax by drink size in Seattle

| | DID (95% CI) ^{1,2} | Pass-through Rate ^{1,3} | N |
|-------------------|-----------------------------|----------------------------------|-------|
| 20-ounce Beverage | 1.79 (1.57, 2.01) * | 102% | 4,726 |
| 2-Liter Beverages | 1.52 (1.31, 1.70)* | 86% | 2,620 |
| 12-pack | 1.86 (1.56, 2.16)* | 106% | 1,960 |

CI = confidence interval; DID= difference-in-difference

¹ Balanced models include beverages (unique brand, specification and size) that were present in the same at baseline and 6-month store audits.

² Tax effects are estimated using difference-in-difference models. The estimate (cents per ounce) represents the effect of tax between baseline and 6-months, above the price changes in the comparison area. Models include store fixed effects and beverage type as covariates.

³ The percent of the 1.75 cents/ounce passed on to consumers.

* $p < 0.05$

Supplemental Table S4: The estimated effect of the tax on non-taxed beverages in Seattle, WA

| | DID (95% CI) ^{1,2} |
|--|-----------------------------|
| Non-Taxed Sugar-Free Beverages³ | N=11,128 |
| All non-taxed sugar-free beverages ⁵ | 0.33 (0.19, 0.47)* |
| Diet Soda | 0.48 (0.31, 0.65)* |
| Diet Sports Beverages | 0.12 (-0.19, 0.44) |
| Diet Energy Beverages | 0.89 (0.43, 1.34)* |
| 100% Juice | -0.28 (-0.87, 0.30) |
| Milk | 0.10 (-0.05, 0.24) |
| Water | 0.05 (-0.23, 0.33) |
| Powdered Sugar Free | 0.02 (-0.05, 0.08) |
| Tea, Bottled Sugar Free | 0.23 (-0.15, 0.61) |
| Coffee, Sugar Free Prepared | 0.10 (-0.95, 1.15) |
| Sugar-Free Syrup Add On ⁶ | 14.92 (-2.32, 32.16) |
| Non-Taxed Sugar-Sweetened Beverages³ | N=1,266 |
| Chocolate Milk | 0.50 (0.07, 0.92)* |
| Powdered Sugar Added | 0.04 (-0.03, 0.11) |
| Store Categories, Non-Taxed Beverages⁴ | N=12,314 |
| Superstores/Supermarkets | 0.11 (-0.03, 0.26) |
| Grocery/Drug Stores | 0.38 (0.16, 0.60)* |
| Small Stores | 0.85 (0.61, 1.08)* |
| Warehouses ⁷ | -0.01 (-0.82, 0.80) |
| Coffee Shops | 0.25 (-0.62, 1.13) |
| Quick Service Restaurants | 0.47 (-0.30, 1.25) |

CI = confidence interval; DID= difference-in-difference

¹ Balanced models include beverages (unique brand, specification and size) that were present in the same at baseline and 6-month store audits.

² Tax effects are estimated using difference-in-difference models. The estimate (cents per ounce) represents the effect of tax between baseline and 6-months, above the price changes in the comparison area. Models include store fixed effects and beverage type as covariates. Standard errors are clustered at the store-level.

³ Models include store fixed effects and beverage size as covariates.

⁴ Models include store fixed effects, beverage size, and beverage type as covariates.

⁵ Excludes sugary syrup add on.

⁶ Cents per flavor shot.

⁷ Standard errors are not clustered.

* $p < 0.05$

Supplemental Table S5. Price per serving in dollars of snack foods, and price per pound of healthier food items, before and after the tax in Seattle, WA

| | DID (95% CI) |
|--------------------------------------|-----------------------|
| Snack Foods^{1,2} | |
| Chips | 0.01 (0.00, 0.03)* |
| Honeybuns | -0.24 (-0.41, -0.07)* |
| Oreos | 0.06 (-0.05, 0.17) |
| Reese's | 0.02 (-0.06, 0.11) |
| Sugary cereals | -0.00 (-0.02, 0.01) |
| Healthier Foods^{3,2} | |

| | |
|----------|----------------------|
| Apple | 0.05 (-0.20, 0.30) |
| Banana | -0.11 (-0.45, 0.23) |
| Tomato | -0.09 (-0.49, 0.31) |
| Onion | -0.44 (-0.90, 0.02) |
| Eggs | -0.24 (-0.45, -0.04) |
| Bread | -0.17 (-0.33, -0.00) |
| Cheerios | -0.42 (-0.82, -0.01) |

CI = confidence interval; DID= difference-in-difference

¹ Snack foods are measured in price per serving.

² Models include store fixed effects.

³ Healthier food are measured in price per pound.

* $p < 0.05$

Supplemental Materials S1.

Comparison area details

The comparison area is a group of three smaller cities that are between 8-20 miles south of Seattle, Kent, Auburn and Federal Way. We chose this as the comparison area for several reasons. For a good comparator on baseline prices of goods and trends in prices, we wanted an area that was subject to the same state and local policies and had a similar economic climate. For example, Washington state and Seattle both had an increase in the minimum wage in January 2018. For small businesses in Seattle, and all business in the rest of the state, the wage increase was the same and was a 4.5% increase; for large business in Seattle, the minimum wage increased by 11%. By choosing a comparison area within Washington state, we are able to make a better case that any changes we do see are less likely to be a result of minimum wage changes (although recent work has indicated that the minimum wage did not affect grocery store food prices: <https://www.mdpi.com/1660-4601/14/9/1039>). We also wanted to avoid places that might introduce a beverage tax during the study period. Tacoma, WA and Portland, OR might have been candidate comparison areas, but when our study began, both places were actively considering beverage taxes.

The similarity of the baseline prices of these goods in the comparison area versus Seattle (shown in Table 2) suggests that the three small cities are similar in terms of general economic climate and quite similar in terms of baseline prices of these goods.

Finally, our decision on the comparison area also was partially based on the fact that we have a second component of our study, which is a cohort study to measure consumption among lower-income families. We wanted to measure prices in the same area where we sampled from for our cohort study (due to limited resources we could not measure prices in more than one comparison area), so we took into consideration also area-level demographics and climate. Our

cohort study recruited lower income families in Seattle, who are concentrated in the South end of Seattle. Table S6 below shows the population demographics of Seattle as a whole, lower income census tracts in South Seattle, and the three smaller cities within our county (and the aggregated comparison) that comprise the comparison area.

Supplemental Table S6. Demographic characteristics of treatment and control groups (individually and aggregated).

| | Seattle (N=708,823) | South Seattle (N=38,660) | Aggregated Comparison (N=303,277) | Auburn (N=79,110) | Federal Way (N=96,110) | Kent (N=128,057) |
|---|------------------------|--------------------------------|---|----------------------|------------------------------|---------------------|
| Race | | | | | | |
| White | 64.5% | 31.1% | 47.6% | 56.6% | 45.4% | 43.7% |
| Black or African American | 6.9% | 22.2% | 10.7% | 4.9% | 13.1% | 12.4% |
| American Indian and Alaska Native | 0.5% | 0.6% | 1.0% | 1.8% | 0.7% | 0.8% |
| Asian | 14.9% | 25.7% | 15.5% | 11.1% | 13.4% | 19.8% |
| Native Hawaiian & Other Pacific Islander | 0.3% | 1.5% | 2.0% | 2.0% | 2.6% | 1.6% |
| Some Other Race | 0.3% | 0.1% | 0.2% | 0.2% | 0.3% | 0.1% |
| Two or More Races | 6.0% | 5.9% | 6.1% | 7.0% | 6.1% | 5.5% |
| Hispanic or Latino | 6.6% | 13.0% | 16.9% | 16.2% | 18.6% | 16.1% |
| Median Household Income | \$85,562 | \$ 45,473 | \$67,988 | \$68,947 | \$66,011 | \$68,880 |
| Per Capita Income | \$55,789 | \$23,580 | \$30,591 | \$31,229 | \$31,438 | \$29,561 |
| Under 200% FPL | 22.1% | 45.9% | 31.2% | 29.2% | 30.7% | 32.7% |

Spatial sampling details

We obtained geographic balance of the stores and restaurants across Seattle and the comparison area by first dividing each study area into 16 equal-sized spatial sampling units (Supplemental Figure S1) using the R package *spsosa* (Spatial Coverage Sampling and Random Sampling from Compact Geographical Strata), then geocoding all the food establishments and the centroid of the polygon shape, which is a random point due to the process for creation of the polygons and then selecting a quota of stores from each store type within each polygon.

We used previously created algorithms by the UW Urban Form Lab to classify each of these businesses into meaningful food store or restaurant categories (supermarkets, grocery stores, corner stores, quick service restaurants, etc.), primarily based on North American Industry Classification System (NAICS) codes (Vernez Moudon et al., 2013). Briefly, first the 3-digit North American Industry Classification System (NAICS) were used to first separate food stores from restaurants. Next, 4-digit NAICS codes were used to divide restaurants into full-service

versus quick service and food stores into broad selection versus limited selection. In the next step, 5- and 6-digit NAICS codes and key word searches using common names in business directories were used to create 18 smaller categories. We used these classifications in our initial sampling strategy, but updated stores type upon physically visiting the store based on store type definitions in the Supplemental Materials below.

Supplemental Table S6. Comparison the distribution of Seattle food stores in the categorized food permit database to our retail audit store sample

| | All Seattle stores in categorized food permit database N = 493 | SBT retail audit store sample N = 134 |
|-----------------------|---|---|
| Store Type | N (%) | N (%) |
| Supermarket | 58 (11.8) | 23 (17.2) |
| Warehouse /Superstore | 7 (1.4) | 7 (5.2) |
| Grocery | 86 (17.4) | 29 (21.6) |
| Small store | 298 (60.5) | 58 (43.3) |
| Drug store | 44 (8.9) | 17 (12.7) |

Store definitions:

Grocery & Food Stores

- 1) **Warehouse** – Warehouses are big-box stores that, like superstores, carry a wide array of products usually including clothing, household items, and often children’s items such as toys. Some general merchandize stores may also have a grocery or **supermarket** within the store. A warehouse is distinguished from a superstore in that it sells items in *bulk*. Examples include Costco or Sam’s Club.
- 2) **Superstore** - Superstores carry a wide array of products usually including clothing, household items, and often children’s items such as toys. Some general merchandize stores may also have a grocery or **supermarket** within the store. Examples include Walmart or Target
- 3) **Supermarket** – To qualify as a supermarket, the store must (1) sell fresh meat (uncooked, unprocessed, not frozen meat, not fish/seafood, not packaged deli meat); (2) have four or more cash registers (including self-checkout); and (3) have at least two of the following services: butcher, bakery and/or deli. The butcher, bakery and deli must be staffed service counters (i.e., availability of fresh bread and/or fresh meat does not count if there is not a separate, staffed service counter). Examples of supermarkets include Safeway, QFC, and Metropolitan Market.
- 4) **Grocery Store** – To qualify as a grocery store, the store must (1) sell fresh meat (uncooked, unprocessed, not frozen meat, not fish/seafood, not packaged deli meat) and (2) not meet all of the criteria for being a supermarket. Examples of

grocery stores include Red Apple, Pioneer Square Market, Viet-Wah, and some ethnic and “mom-and-pop” food stores.

- 5) **Drug Store/Pharmacy** – This includes stores that sell prescription and over the counter medication, as well as additional merchandise including food and beverages. Examples include Walgreens, CVS, and Rite Aid.
- 6) **Small Stores** – Store types **A-D** qualify as “small stores.” These stores **do not** sell fresh meat. They may, but typically do not, have deli and/or bakery service counters. Please note there **should not be butcher or fresh meat** service counters and this is why they are identified as small stores.
 - a. **Chain Convenience**- This includes small chain stores that sell an edited selection of staple groceries and other convenience items, i.e., ready-to-heat and ready-to-eat foods. They often sell fresh milk and may have a deli or sell some processed meats (hot dogs, cold cuts, etc.) and other hot foods. Convenience stores are typically open long hours. Examples of convenience stores are 7-Eleven and Plaid Pantry. In this study, based on pre-screening, we will indicate chain versus non-chain status for field workers.
 - b. **Non-Chain Convenience**- This includes small, independently-owned stores that sell an edited selection of staple groceries and other convenience items, i.e., ready-to-heat and ready-to-eat foods. They often sell fresh milk and may have a deli or sell some processed meats (hot dogs, cold cuts, etc.) and other hot foods. Convenience stores are typically open long hours. Please note that corner stores will also be classified as non-chain convenience stores. Examples include Union Market, and many ethnic and “mom and pop” stores.
 - c. **Discount Store** – This includes small stores that sell a variety of goods like household, personal, and party supplies and household cleaning products, as well as some food and beverages, typically at discounted prices. We will include stores that have the word “dollar” or “discount” in the title. Examples include Dollar General and Dollar Tree.
 - d. **Gas Station** – This includes the quick-stop shops at gas stations. Gas station shops sell a selection of snacks, beverages, convenience items, and ready-to-heat and ready-to-eat foods. They may sell a selection of staple groceries. To be a gas station store, these stores must have gas pumps connected to the store. A few stores, such as 7-11s, can be both “gas stations” and “chain convenience stores.” The distinction is the presence of gas pumps. Examples include AMPM, 76, or Shell.

Beverage Stores

- 1) **Coffee Shop** – A small café that serves primarily coffee as well as other drinks. Usually but does not have to serve simple foods. Can be a separate building, or inside of a larger store or restaurant. Can be a drive-thru or a walk-in café. If it is a drive-thru only coffee stand, only survey if the coffee stand has a menu that is visible to the exterior. If there is no exterior menu, do not survey the shop.
- 2) **Bubble Tea Shop** – A small café that serves primarily bubble tea as well as other drinks, including coffee. Can serve simple food. Can be a separate building, or inside of a larger store or restaurant.

Fast Food / Quick Service

- 1) **Quick Service Chain** – A restaurant that serves fast food cuisine and has minimal table service. Food is usually offered from a limited menu, cooked or prepped in bulk in advance and kept hot, finished and packaged to order, and usually available for take away, though seating may be provided. “Fast casual” are also included in this category, and tend to have more seating, and food items that are made-to-order. “Chain” quick-service refer to national fast-food brands (e.g., McDonalds, Dairy Queen, Taco Bell).
- 2) **Quick Service Non-Chain** – A restaurant that serves fast food cuisine and has minimal table service. Food is usually offered from a limited menu, cooked in bulk in advance and kept hot, finished and packaged to order, and usually available for take away, though seating may be provided. “Fast casual” are also included in this category, and tend to have more seating, and food items that are made-to-order. “Non-chain” quick-service refers to chains that are *not* national chains / brands. Local chains (e.g., Dicks, Pagliacci Pizza) are included in this category.

AUTHOR CONTRIBUTIONS

JC Jones-Smith: Conceptualization, Supervision, Methodology, Validation, Formal analysis, Writing – Original Draft, Funding acquisition; **L Pinero Walkinshaw:** Software, Formal analysis, Resources, Data Curation, Writing – Review & Editing, Project administration; **VM Oddo:** Formal analysis, Writing – Original Draft; **M Knox:** Conceptualization, Writing – Review & Editing; **ML Neuhauser:** Conceptualization, Writing – Review & Editing; **PM Hurvitz:** Methodology, Software, Formal analysis, Writing – Review & Editing; **BE Saelens:** Conceptualization, Writing – Review & Editing; **N Chan:** Conceptualization, Writing – Review & Editing, Funding acquisition.